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Kort, Peter

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OPTIMAL ABATEMENT POLICIES WITHIN A STOCHASTIC DYNAMIC MODEL OF THE FIRM

Peter M. Kort
Economics Department
Tilburg University
P.O. Box 90153,
NL-5000 LE Tilburg

Nowadays, the improvement of environmental quality has become one of the most important objectives in the industrialized world. From an economic point of view one could argue that a non-polluted environment has become a scarce commodity. Consequently, environmental use is an allocation problem (Siebert (1987)) and should be taken into consideration by economic theory. This seems to be the reason that more and more books are devoted to environmental economics (e.g. Baumol and Oates (1988), Wicke (1982)).
An important question in this respect is what kind of policy instruments the government, in its role as social planner, should choose to reduce the level of pollution. One class of instruments includes direct controls by setting limits to the amount of effluent that the factories can discharge into a stream (Beavis and Dobbs (1986)). Another mechanism for the attainment of a given environmental target is the standard-price-approach (Baumol and Oates (1971)). The basic idea of this concept is to meet a given quantity of emissions by rationing the demand for emission permits by prices. The influence of an emissions tax on the economic behavior of government and firm is studied within a macroeconomic differential game framework by Gradus and Kort (1991). In Kort, Van Loon and Luptacik (1991) a deterministic dynamic model of the firm is developed to analyze the optimal reaction of the firm when the government imposes an emissions tax rate and offers a grant on investments in cleaner technologies and abatement activities.

In this paper we extend the work of Kort, Van Loon and Luptacik (1991) by introducing uncertainty into the analysis. To do so we extended a stochastic dynamic model of the firm developed by Bensoussan and Lesourne (1980) by incorporating activity analysis (cf. Van Loon (1983)). We considered two activities: the first one is productive but also causes pollution that is taxed by

the government. The second one is non-productive but abates pollution so that tax payments are reduced.

It turned out that investments in the abatement activity can be optimal when the following conditions are satisfied:

- the reduction in emissions tax due to an additional abatement investment of one dollar has to be greater than the shareholders' time preference rate;
- the liquidity position of the firm has to be strong;
- the expected marginal earnings of productive investment must be lower than the reduction in emissions tax due to an additional abatement investment of one dollar.

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